The EMBO biocatalysis conference "The biochemistry and chemistry of biocatalysis: From understanding to design"

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In this special issue of PEDS papers are published on the theme of biocatalysis, being related to the theme of the biennual EMBO biocatalysis conference, organized June 2016 at the University of Oulu, Oulu, Finland. This special issue of PEDS, like the conference, covers a diverse range of approaches by which researchers aim to achieve a better understanding of biocatalysis mechanisms. New bioinformatics tools for finding relevant structural data available at the EBI enzyme portal, are described by Maria Martin and coworkers. QM-approaches focusing on active site properties of a carbon monoxide dehydrogenase are addressed by Claudio Greco. The biocatalytic properties of enzymes are captured in the kinetic parameters k_{cat}, K_m and k_{cat}/K_m (Fersht, 1999). The study by Gideon Schreiber describes a computational tool to extract these kinetic parameters from a single progress curve. Obtaining these parameters by calorimetry measurements is described by Annemie Lambeir, highlighting the value of this method when studying the kinetic properties of proline specific serine hydrolases. Following in the footsteps of Bill Jencks (Jencks, 1987), John Richard reviews the insight obtained from his kinetic experiments with three enzymes having a substrate that includes a phosphate moiety. The kinetic data show that the phosphate moiety not only contributes to favorable enzyme-substrate interactions with the substrate itself, but additional favorable enzyme-transition state interactions contribute much to the biocatalytic properties of these enzymes. Several papers address the design and development of non-natural enzymes, such as for example the paper by Dick Jansen and coworkers using computational approaches to improve the applicability of a halohydrin dehalogenase as a biocatalyst for reactions in the presence of organic cosolvents. Another example concerns the reengineering of an unspecific peroxygenase, by Miguel Alcalde, increasing its selectivity for specific C-H oxyfunctionalizations, which is of great interest in organic synthesis. In this study the peroxygenative:peroxidative activity ratio of the target enzyme is improved, first by structure-guided mutagenesis and subsequently by targeted combinatorial saturation mutagenesis. Substrate channeling is an intriguing phenomenon, known to occur *in vivo* (Srere, P. A., 1985). The substrate channeling mechanisms of small apolar intermediates, which channel through the matrix of the enzyme, are well studied, but substrate channeling of larger polar molecules, requiring surface crawling, are poorly understood. The best studied multifunctional enzyme in this respect is the TS-DHFR bifunctional enzyme. The paper by Karen Anderson on this topic provides an up to date overview of the current understanding of the channeling of the dihydrofolate intermediate in the studied TS-DHFR bifunctional enzymes. The papers collected in this special issue of PEDS are up to date snapshots of ongoing research efforts aimed at improving the understanding of the fascinating biocatalytic power of enzymes and their metabolic pathways, thereby allowing the development of more sustainable production methods for bulk chemicals as well as for high value pharmaceuticals.

References

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